National Aeronautics and
Space Administration

Office of Biological and Physical Research

# FIGHTING FIRE IN MICROGRAVITY

PHYSICAL SCIENCES RESEARCH
BIOASTRONAUTICS RESEARCH
FUNDAMENTAL SPACE BIOLOGY
**SPACE PRODUCT DEVELOPMENT**

## Why is it important?

Since World War II, the most effective fire-fighting method has been high-pressure water sprays. How the droplets interact with the flames is largely unknown, partly because in Earth's gravity, a fire's heat generates air currents that make it difficult to study combustion. In space, however, water must be sprayed sparingly since it will not run off but can accumulate and be difficult to clean up.

## What is NASA doing?

Environmental Engineering Concepts, Inc., and Arizona Mist, Inc., have partnered with the Center for the Commercial Applications of Combustion in Space (CCACS), a NASA-sponsored Commercial Space Center, to investigate the use of fine water mists in fighting a fire. The Water Mist experiment employs a two-part chamber with water on one side and a fuel-air mixture on the other. In microgravity, scientists will be able to study how a flame front moves into the mist and is extinguished, all without the convection that would occur on Earth. The first flight will be on STS-107 in 2003.

## What are the benefits?

Replacing halon gases (banned by the 1987 Montreal Protocol) is expected to become an increasingly large part of the $2-billion-a-year fire suppression industry; the research being done on STS-107 is of great commercial interest. Potential benefits include the following:

- enabling the next generation of environmentally friendly and low-cost fire-fighting systems,
- minimizing water damage by using less water, and
- developing crew- and equipment-safe fire-control systems for use on spacecraft.

## What is next?

Data from the investigations on STS-107 will be used on the ground to improve computer and mathematical models and allow detailed simulations to test theories and obtain more accurate results. Water mist investigations on the International Space Station will be able to use different water injection systems, droplet sizes, and other fire scenarios to support this important research.

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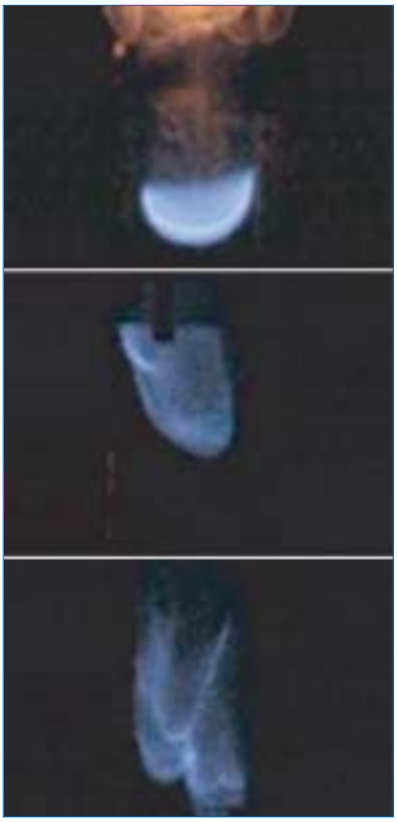

A low-gravity test of the Mist experiment shows (from top to bottom) a flame after ignition, encountering water mist, and slowing down and breaking up. Space experiments will allow longer, more definitive experiments than are possible on Earth.

The drawing to the right illustrates the fine scale of the droplets that will be formed in Water Mist as compared to 1-mm droplets formed by conventional water sprays. Small droplets have more surface area to absorb heat, but the dynamics of fire extinction are poorly understood.